

CLAIMS

What is claimed is:

1. A method for controlling resources integrated to perform a process on a work product within an environment where at least one of a first of the resources and the work product is a moveable item that moves during the process, the method comprising the steps of:
 - 5 providing an information device on the moveable item;
 - ascertaining the location of the information device; and
 - controlling at least a first of the resources as a function of the location of the information device.
2. The method of claim 1 wherein the moveable item is the product.
3. The method of claim 2 wherein the step of providing an information device includes providing a sensor on the product, the step of ascertaining the location of the information device including obtaining information from the environment via the sensor.
4. The method of claim 3 wherein the step of providing an information device includes providing a processor linked to the sensor, the step of ascertaining the location of the information device further including the step of using the processor to determine the location based on the obtained information.
5. The method of claim 4 further including the steps of providing at least one stationary transmitter within the environment and transmitting signals from the transmitter within the environment, the step of obtaining information including obtaining at least a sub-set of the signals transmitted by the transmitter.
6. The method of claim 5 wherein the step of using the processor to ascertain the location includes performing at least one of a triangulation method, a signal strength method and a statistical analysis method.

7. The method of claim 4 for use with a controller that controls the resources, wherein the step of providing an information device further includes providing a transmitter linked to the processor, the step of determining location further including the step of wirelessly transmitting the device location from the
5 transmitter to the controller.

8. The method of claim 7 wherein the resources include at least a first resource having a location known to the controller and controlled by the controller to perform a process on the work product when the information device is in a first juxtaposition with respect to the first resource, the step of controlling including the
5 step of initiating the first resource process when the information device is in the first juxtaposition.

9. The method of claim 8 further including the step of determining the location of the first resource.

10. The method of claim 3 further including the step of providing a set of stationary positioning labels at various locations within the environment, each label indicating the position thereof, the step of obtaining information including the step of, when the product is proximate one of the labels, obtaining the location information
5 from the proximate label.

11. The method of claim 10 wherein the step of ascertaining further includes, when the product is between two of the stationary labels, estimating the location of the product from the location of at least the label that the product was most recently proximate.

12. The method of claim 11 wherein the step of estimating also includes estimating as a function of the time since the product was most recently proximate one of the labels.

13. The method of claim 12 wherein the step of estimating also includes estimating as a function of the velocity at which the product is moving within the environment.

14. The method of claim 2 wherein the resources include at least a first resource having a location known to the controller and controlled by the controller to perform a process on the work product when the information device is in a first juxtaposition with respect to the first resource, the step of controlling including the
5 step of initiating the first resource process when the information device is in the first juxtaposition.

15. The method of claim 14 further including the step of determining the location of the first resource.

16. The method of claim 2 for controlling resources integrated to perform the process on multiple similar work products within the environment, the step of providing an information device on the work product including providing an information device on each of the work products and at the same locations on each
5 of the work products.

17. The method of claim 2 further including the step of ascertaining the orientation of the work product and wherein the step of controlling includes controlling the resources as a function of both the location of the information device and the orientation of the work product.

18. The method of claim 17 wherein the information device is a first information device and wherein the step of ascertaining the orientation includes the step of providing at least a second information device on the work product and ascertaining at least one of the location of the second device and the relative
5 juxtaposition of the second device to the first device.

19. The method of claim 18 wherein the step of determining the orientation includes providing at least a third information device on the work product and ascertaining at least one of the location of the third device and the relative juxtaposition of the third device to at least one of the first and second devices.

20. The method of claim 2 wherein the step of providing an information device includes providing at least first and second information devices on the work product and wherein the step of ascertaining the location includes ascertaining the location of at least one of the first and second information devices.

21. The method of claim 2 wherein the step of providing an information device includes providing a transmitter, the step of ascertaining the location including providing at least one sensor in the environment for receiving signals transmitted by the transmitter, receiving transmitted signals and using the transmitted signals to
5 ascertain the location.

22. The method of claim 21 wherein the step of ascertaining includes performing at least one of a triangulation process, a signal strength process and a statistical analysis process on the received transmitted signals.

23. The method of claim 21 wherein the information device transmits a signal identifying the work product.

24. The method of claim 21 wherein the resources include at least a first resource having a location known and controlled by the controller to perform a process on the work product when the information device is in a first juxtaposition with respect to the first resource, the step of controlling including the step of initiating
5 the first resource process when the information device is in the first juxtaposition.

25. The method of claim 24 further including the step of determining the location of the first resource.

26. The method of claim 2 further including the step of storing process data on the information device from which a process to be performed by at least the first resource can be identified.

27. The method of claim 26 further including the step of identifying the process data and using the process data to identify the process to be performed, the step of controlling as a function of location including controlling as a function of both location and the identified process.

28. The method of claim 26 further including the step of storing correlated product identifiers and processes to be performed on the products in a database, the step of storing process data including the step of storing a product identifier, the step of identifying the process data and using the process data including identifying the product identifier, accessing the database and identifying the correlated process as the process to be performed.

29. The method of claim 27 wherein the identified process specifies at least one component to be added to the product by the first resource, the method further including the steps of, confirming that a component to be added to the product is at least one instance of the specified component and then performing the identified process.

30. The method of claim 29 further including the steps of providing an information device on the component to be added to the product and storing a component identifier in the information device on the component, the step of confirming including obtaining the component identifier from the information device on the component and comparing the component identifier to the specified component and, when the component identifier matches the specified component, performing the identified process.

31. The method of claim 30 further including the step of identifying the location of component to be added to the product.

32. The method of claim 3 further including the step of providing a set of stationary information device sensors at various locations within the environment, each sensor capable of sensing the presence of the information device, the step of obtaining information including the step of, when the product is proximate one of the sensors, sensing the presence of the information device.

33. The method of claim 32 wherein the step of ascertaining further includes, when the product is between two of the stationary sensors, estimating the location of the product from the location of at least the sensor that the product was most recently proximate.

5 34. The method of claim 32 wherein the step of estimating also includes estimating as a function of the velocity at which the product is moving within the environment and the time since the product was proximate the sensor.

35. The method of claim 2 further including the steps of providing information devices on other work products within the environment and ascertaining the locations of the other work products within the environment, the step of controlling the first resource further including the step of controlling the first resource
5 as a function of the locations of at least a sub-set of the work products.

36. The method of claim 1 wherein the information device is reusable.

37. The method of claim 1 wherein the resources include machines for performing an automated industrial process.

38. The method of claim 13 wherein the step of estimating also includes estimating as a function of the acceleration of the product within the environment.

39. The method of claim 20 wherein the step of ascertaining includes performing at least one of a triangulation process, a signal strength process and a statistical analysis process on the received transmitted signal.

40. The method of claim 33 wherein the step of estimating also includes estimating as a function of the acceleration of the product within the environment.

41. The method of claim 1 wherein the information device is non-reusable.

42. A method for verifying that a component is a first component prior to integrating the component with a product assembly, the method comprising the steps of:

5 providing a separate information device on each of at least a subset of components and on the product assembly where each of the information devices indicates the identity of the component/assembly on which the device is located; specifying that the first component is to be integrated with the assembly at a first station;

10 when the assembly is located at the first station, identifying the assembly via the information device on the assembly and the specified integration of the first component with the assembly and, when a component is present at the assembly to be integrated with the assembly and prior to integrating the component with the assembly, determining the identity of the component via the information device on the component and integrating the component with the assembly only when the

15 component is the first component.

43. The method of claim 42 further including the step of identifying that the assembly is at the first station by identifying the location of the information device on the assembly.

44. The method of claim 43 further including the step of determining that a component is at the first station to be integrated with the assembly by determining the location of the information device on the component.

45. The method of claim 42 wherein, when the component is other than the first component, the method further includes the step of performing a secondary function.

46. The method of claim 45 wherein the secondary function is to activate an alarm indicating that an incorrect component set is present at the first station.

47. The method of claim 45 wherein the secondary function is to locate the first component via the information device on the first component and transfer the first component to the first station to be integrated with the assembly.

48. A method for verifying that components to be integrated by a machine line station within an enterprise are the correct components prior to integration, the method comprising the steps of:

providing a separate information device on each component within the
5 enterprise where each of the information devices indicates the identity of the component on which the device is located;

specifying that a first component is to be integrated with a second component at a first station;

when the first component is located at the first station, identifying the identities
10 of the first and at least another component at the first station via the information devices prior to integrating the components and, when the another component is other than the second component, performing a secondary function.

49. A method for tracking work product within an environment, the method comprising the steps of:

providing environment information within the environment from which information device location can be ascertained;

5 providing an information device on each of the products;

at least periodically obtaining environment information via each of the information devices; and

using the environment information to determine the locations of the information devices within the environment.

50. The method of claim 49 wherein the step of providing an information device on each of the products includes the step of providing at least a receiver on each of the products, the step of providing environment information includes providing at least one transmitter within the environment for transmitting signals
5 within the environment and the step of obtaining information including obtaining at least a sub-set of the transmitted signals within the environment.

51. The method of claim 50 wherein the step of providing an information device on each product further includes providing a processor on each of the products that is linked to the receiver and wherein the step of using the information includes causing the processor to determine the product location as a function of the
5 obtained signals.

52. The method of claim 51 wherein the processor determines the product location by performing at least one of a triangulation method, a signal strength method and a statistical analysis method.

53. The method of claim 49 wherein the step of providing environment information includes providing position labels within the environment at spaced apart locations, the step of obtaining information from the labels when the information devices are proximate the labels.

54. The method of claim 50 wherein the step of providing the information device further includes the steps of providing a separate transmitter linked to each of the receivers, the step of using the environment information includes providing a control processor linked to an environment receiver within the environment,
5 transmitting the environment information to the control processor via the environment receiver and using the control processor to determine the locations of the products.

55. A method for tracking components within an environment wherein resources assemble the components to form products, the method comprising the steps of:

- 5 a) providing an information device on each of at least a sub-set of the components within the environment;
- b) determining the locations of each of the sub-set components; and
- c) storing the location of each component in the information device that is on the component.

56. The method of claim 55 further including the step of storing identifier information on each of the information devices indicating the identity of the component on which the information device is located.

57. The method of claim 55 further including rendering the location and identifier information accessible to at least one sensor located within the environment.

58. The method of claim 55 wherein steps (b) and (c) are repeated periodically.

59. The method of claim 55 wherein the step of providing an information device includes providing a processor on each of the components that determines the location of the component.

60. The method of claim 55 further including the steps of providing at least one sensor within the environment for at least periodically obtaining location information from each of the information devices.

61. The method of claim 60 further including the step of controlling the resources at least in part as a function of the locations of the components.

62. An apparatus for tracking a component within an environment wherein resources assemble the component with other components to form products, the apparatus comprising:

- a processor spatially associated with the component;
- 5 a data collector linked to the processor, the collector obtaining information from the environment from which collector location can be determined; and
- a memory linked to the processor, the processor storing current component location within the memory.

63. The apparatus of claim 62 wherein processor is mounted to the component.

64. The apparatus of claim 63 for use with at least one stationary transmitter within the environment, the collector including a receiver for receiving signals transmitted by the transmitter.

65. The apparatus of claim 64 also for use with at least one receiver within the environment, the collector also including a transmitter for transmitting signals to the receiver indicating the location of the collector.

66. The apparatus of claim 62 wherein an apparatus identifier number is also stored in the memory for uniquely identifying the apparatus.

67. An assembly for tracking components within an environment wherein resources assemble the components to form products, the assembly comprising:

a server linked to at least a sub-set of the resources and programmed to control resources as a function of the locations of components within the

5 environment; and

a plurality of tags, a separate tag spatially associated with each of the components;

wherein, at least one of the tags and the server is programmed to determine the locations of the tags within the environment.

68. The assembly of claim 67 wherein each tag includes a memory and a transmitter, a tag specific ID stored in the memory, the transmitter transmitting the tag ID within the environment.

69. The assembly of claim 68 further including at least one receiver linked to the server for receiving tag IDs transmitted within the environment.

70. The assembly of claim 69 wherein each tag also includes a processor and a tag receiver, the assembly further including at least one stationary transmitter within the environment and linked to the server, the stationary transmitter transmitting signals within the environment, the tag receivers receiving the

5 transmitted signals from the stationary transmitter, the tag processors each using the received signals to determine the locations of the tag receivers, the tag transmitters, in addition to transmitting the tag IDs, also transmitting the tag locations to the receiver linked to the server.

71. The assembly of claim 69 wherein the server uses the tag ID signals to determine the location of the transmitting tag.